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## *U.S. Naval Sea Systems Command*



### *Guidebook for Oil Pollution Abatement Systems on Surface Ships*

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## NOTICE

*This Guidebook is distributed to provide you, the technician, with the general information you need to understand an Oil Pollution Abatement System.*

***THIS GUIDEBOOK DOES NOT** replace the technical manuals published and distributed by the Naval Sea Systems Command for any component of an OPA system installed on your ship. Refer to the appropriate technical manual for all data required to maintain and repair that equipment.*

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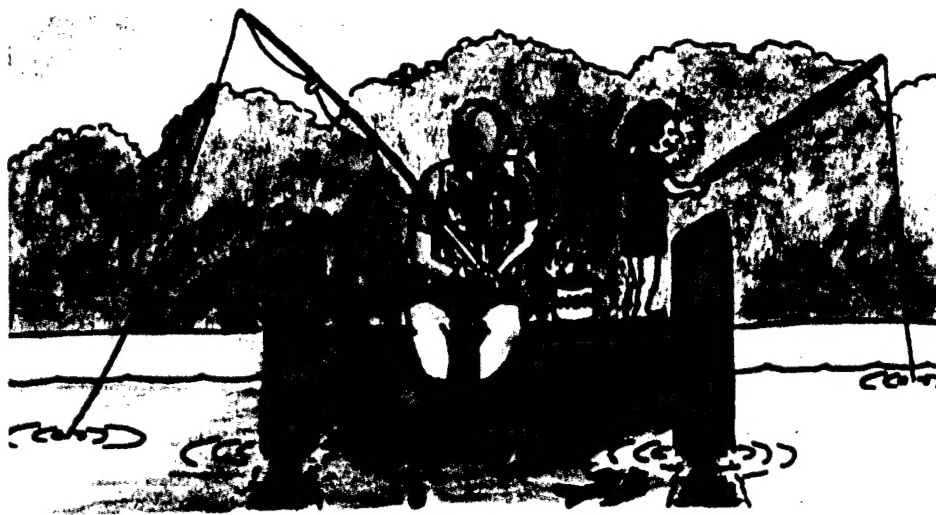
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## *At a Glance*

*Info common to Oil Pollution Abatement Systems.*

Do you fish from piers? Think about the oil that could be in the bilge water your ship could send over the side and multiply that times the number of ships in port.

*Why is this stuff on  
my ship?*



The Navy doesn't want to further pollute our ports and harbors. On your ship, the Navy installed an Oil/Water Separator (OWS) for separating oil from water, and possibly an Oil Content Monitor (OCM) to help you tell

**BTIC QUALITY INSPECTED 4**

*Page-1*

if the water you need to send overboard will cause any pollution. The Navy wants you to use this equipment.

*Who's responsible?*

**You** are responsible for ensuring that the equipment works properly.

# Alphabet Soup

*There are always abbreviations, acronyms, and terms...*

*Aqueous Film-Forming Foam*      AFFF

*Act to Prevent Pollution from Ships*      APPS

*Corrugated polypropylene plates stacked to trap oily waste from the OWHT.*      Coalescing Plate Stack

*gallons per minute*      gpm

*International Maritime Organization*      IMO

*International Maritime Convention for the Prevention of Pollution from Ships*      MARPOL

*nautical mile*      nm

*Oil Content Monitor*      OCM

*An oil/water mixture containing a water content greater than 50%, rendering the oil unusable. (The mixture may also contain other non-petroleum matter.)*      Oily Water

*Oil Pollution Abatement system (usually consists of an OWS with an OCM)*      OPA

*Oily Waste Holding Tank*      OWHT

OWS	<i>Oil/Water Separator</i>
OWTS	<i>Oily Waste Transfer System</i>
ppm	<i>parts per million</i>
Reclamation	<i>Processing of used oil to recover useful products.</i>
Used Oil	<i>Oil with refining characteristics changed since its original refining but that may be suitable for future use and is economically reclaimable. This involves petroleum-based products, not synthetics.</i>
Waste Oil	<i>Used oil that cannot be reclaimed economically and, therefore, is not suitable for future use.</i>
WOT	<i>Waste Oil Tank</i>

# *OPA Components*

## *What is an Oil Pollution Abatement System?*

The OWS separates oil from bilge water by forcing the oil to coalesce on corrugated stacked plates. Some OWSs process 10 gpm while others can handle high-capacity flows.

### *Oil/Water Separator*

The OCM is designed to check water processed by the OWS before it is pumped overboard. If the OCM detects trace amounts of oil, then that water sample is diverted to the Oily Waste Holding Tank (OWHT).

### *Oil Content Monitor*

The raised portion of the OWS known as the Oil Tower passively collects separated oil via the action of gravity, after oil droplets form on the coalescing plates. Oil is discharged from the OWS through a connection at the top of the Oil Tower to the Waste Oil Tank (WOT).

### *Oil Tower*

The OWHT collects oily water and stores it until that waste is pumped out of the tank by the OWS.

### *Oily Waste Holding Tank*

***Waste Oil Tank***

The WOT holds all oil reclaimed by the OWS until ship's company can off-load it to proper shore facilities.

***Oily Waste Transfer System***

The OWTS includes the transfer pumps, piping risers, and weatherdeck connections that allow the safe and convenient transfer from ship to shore of oily waste.

***Discharge Connections***

2½-inch cam-lock discharge connections (MS27023-14) designed for waste oil and oily water discharge provide the ability to conduct quick connect/disconnect with shoreside off-loading hoses.

***Discharge Adapters***

Oily water/waste oil discharge adapters are used in foreign ports to accommodate hoses having IMO-standard flanges.

***Mechanical Seals***

Mechanical seals are fitted to pumps so only a minimal quantity of oily water is collected in the ship's bilges.

***Tank Level Indicators***

Improved tank level indicators reduce the potential for overboard spills that could occur during fueling and while handling and transferring oily waste.



# *OPA Components*

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### *Oily Waste Holding Tank*

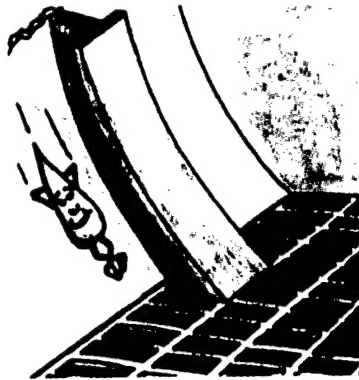
# A Tale of Two Droplets ...

*I know that oil and water don't mix, but...*

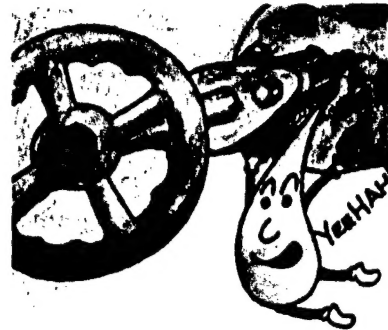
Some examples of the sources of water that runs off into the bilge are:

*How does water get into my bilge?*

- *Condensation from uninsulated hull*



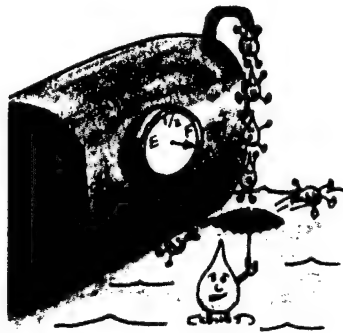
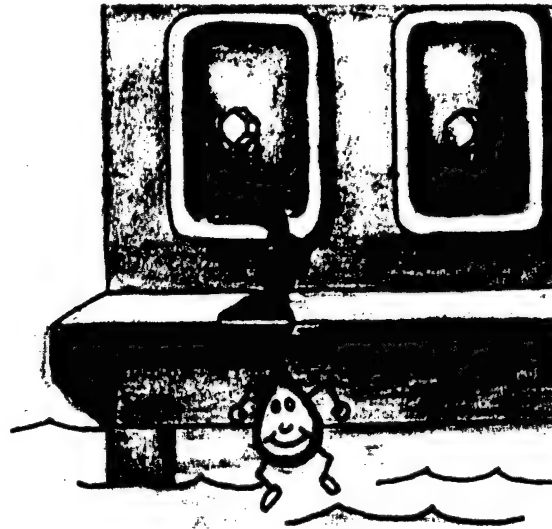
- *Leaky valves, seals, & fittings*
- *Air conditioner condensation*



*How does oil get into  
my bilge?*

Oil can leak from any number of sources,  
including:

Leaks from any machine.

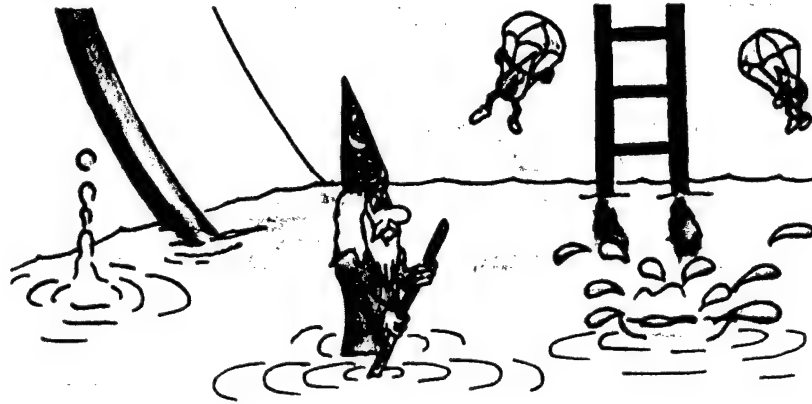


Any number of tanks can overflow, and the  
overflow will drain to the bilge. Some  
examples of these tanks include:

- *Synthetic Waste Oil Tank*
- *Fuel Stripping Tank*

Waste oil and water collect and mix in bilge drainage wells or troughs, depending upon the ship and its configuration.

*Where does this stuff collect?*



Someone (possibly you and your gang) uses the OWTS to pump it into the OWHT.

*What happens to it next?*

The oily water collects in the OWHT until it is pumped through to the OWS.

*OK, now what?*

If the oily water hasn't been emulsified by detergents, particularly AFFF, oil droplets of at least 20 microns in size will coalesce on the corrugated stacked plates in the OWS while the waste water passes right by.

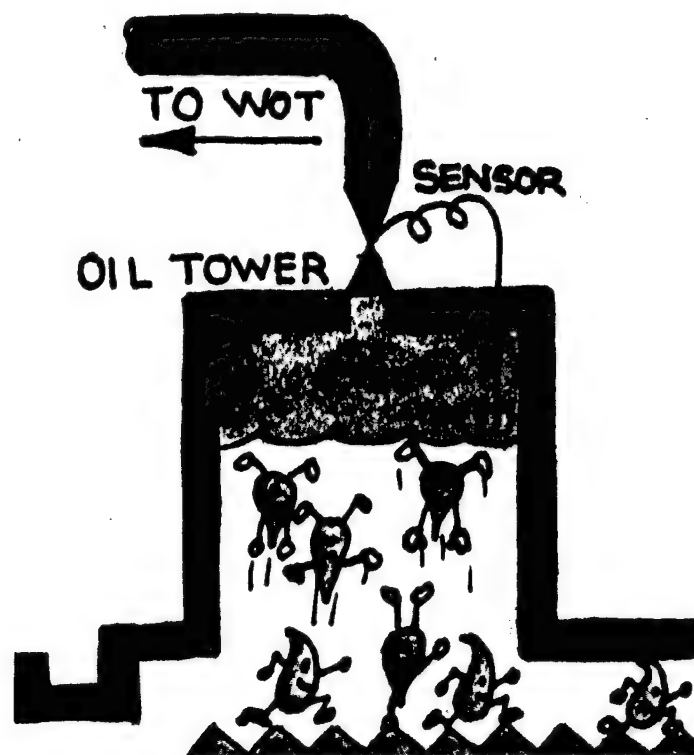
*What happens in the OWS?*

*Where does the oil  
drop go?*

The oil drop rises into the Oil Tower.

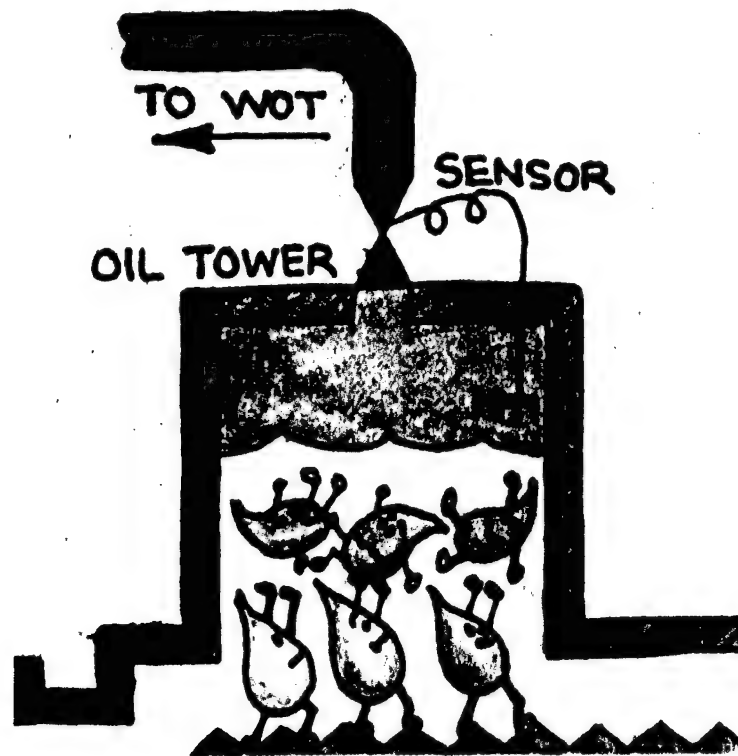
*How does that  
happen?*

The oily water passes through the OWS,  
where the coalescing plates force oil droplets  
to combine and rise into the Oil Tower.



Gravity works. The water pushes the oil up into the tower. More oil is coalesced from additional oily water as it passes through the corrugated plates.

*Huh ...?*



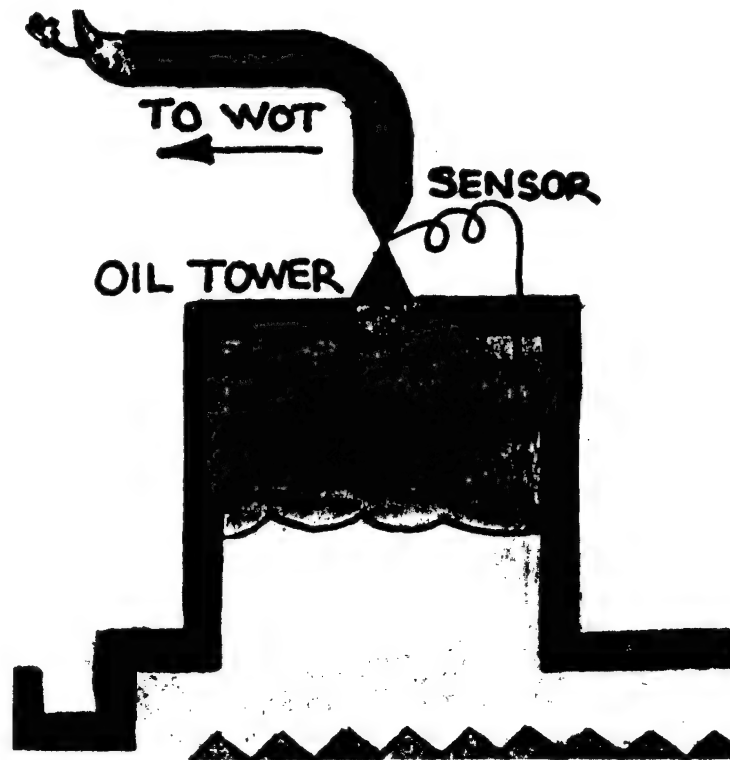
Yes. However, it only serves to force the oil up and out of the Oil Tower.

*Doesn't water rise in the tower, too?*

Where does the oil

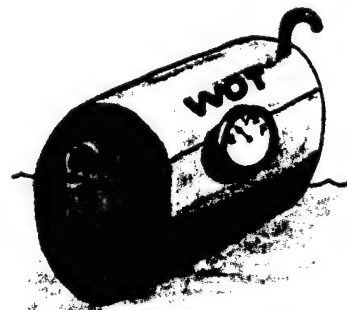
To the WOT.

go?



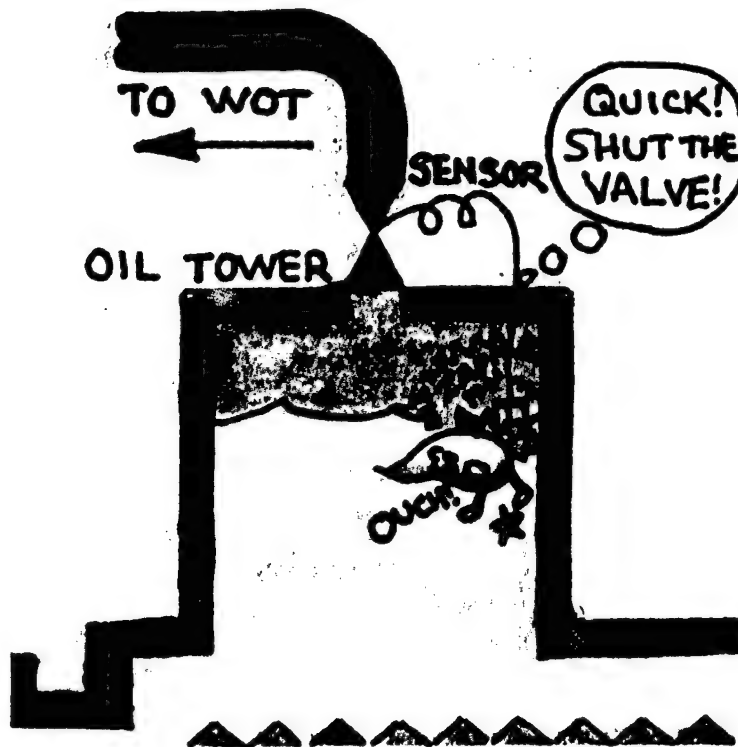
What do we do with it  
then?

Keep it. Navy and international regulations prohibit discharge of waste oil overboard. At least, keep it until you enter port and can off-load it to a shore facility for recycling.



Very little.

Does water get into  
the WOT?



A three-pronged conductance sensor in the Oil Tower controls the output valve from the Oil Tower. When it senses water, it shuts off that valve.

*Why not?*

When it has passed through the OWS, water is sent through a valve to the OCM.

*Where's the water?*

This water is known as *effluent*.

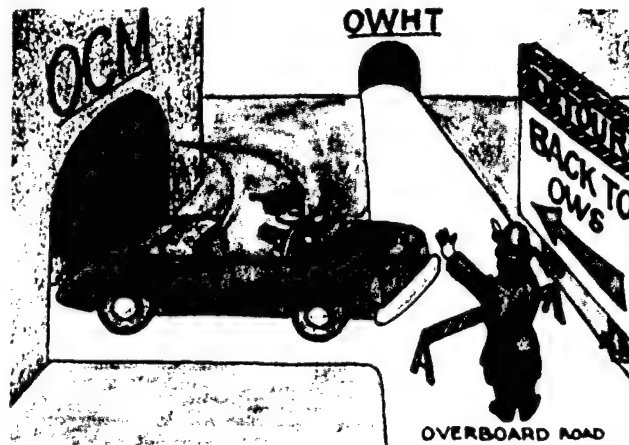


*How good is the  
OWS?*

NAVSEA expects the OWS to remove 95% of the oil from the water that passes through the coalescing plates.

*Is this enough?*

Sometimes it's not.



*How does the OPA  
system know this?*

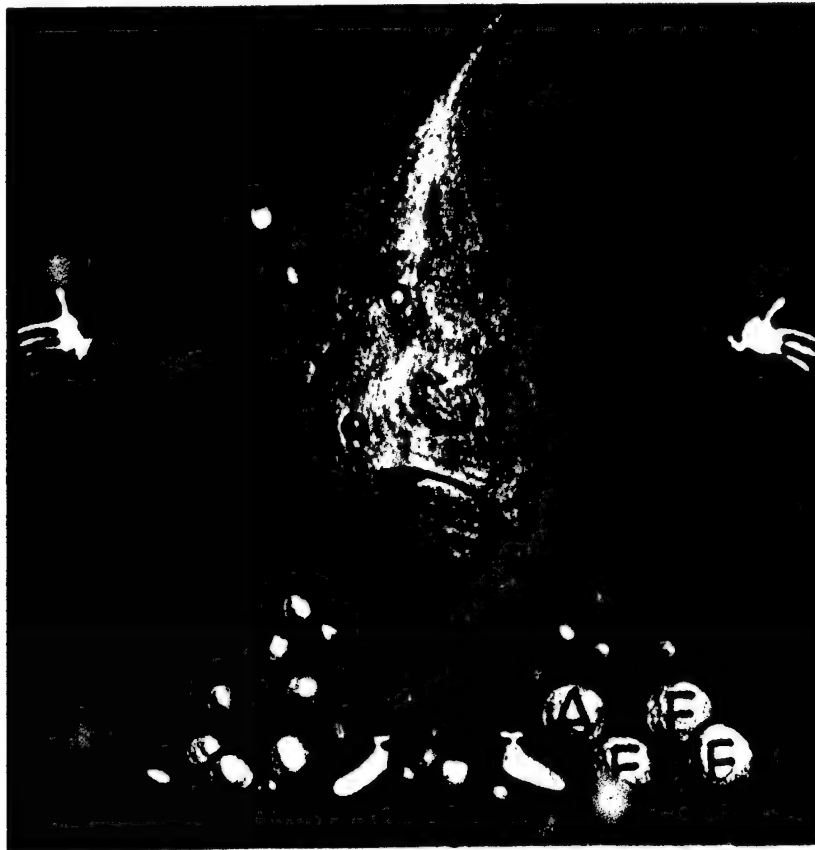
A sample of the water released to the discharge line by the OWS goes to the OCM. If the OCM detects more oil in the water than the threshold is set to allow, then it does not allow that water to be pumped overboard.

*What happens then?*

The OCM reroutes oily water to the OWHT, where it returns to the OWS to be cleaned. This is repeated until the water is separated from the oil enough to be discharged overboard.

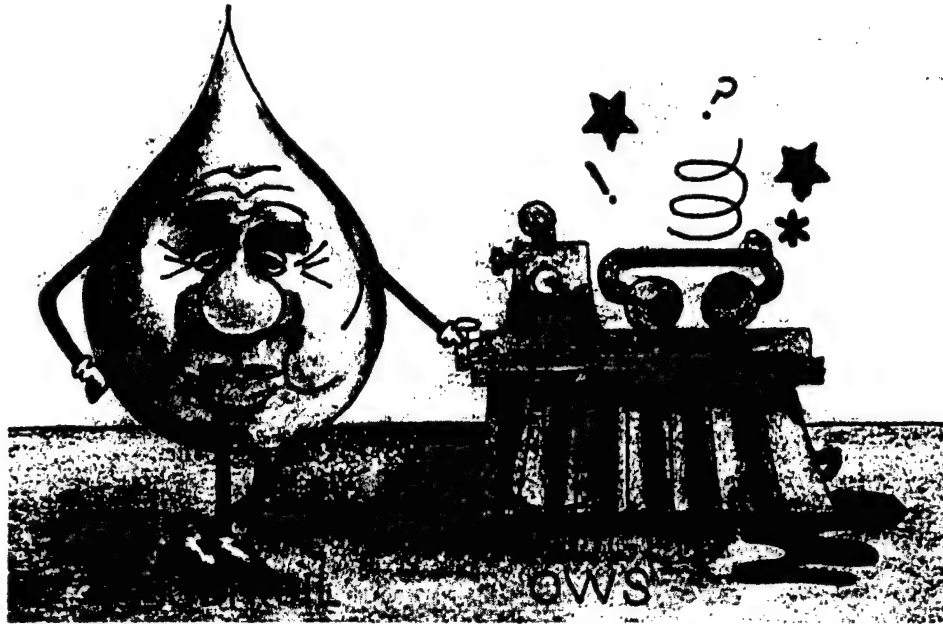
## *What can go wrong?*

- 1. If the oil has been emulsified by AFFF, the oil droplets will be considerably smaller than 20 microns and won't coalesce on the OWS corrugated plates.*
- 2. The coalescing plates will sludge up very quickly if the OWS is not cleaned regularly.*
- 3. If the corrugated plates are sludged up by coagulated oil, the system won't work.*



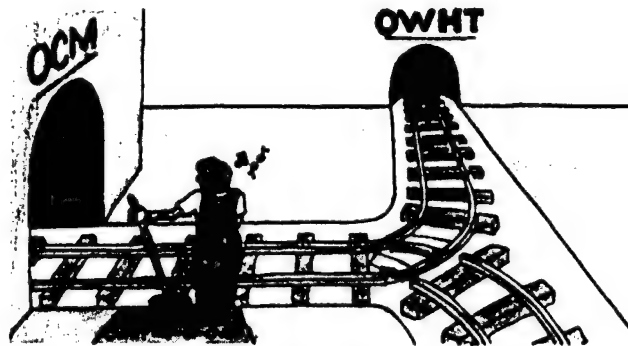
*So what if they're  
sludged?*

When the coalescing plates are sludged, both  
oil and water pass right through the OWS.



*Doesn't the OWS  
correct for this?*

No.



No.

*Does oil go overboard*

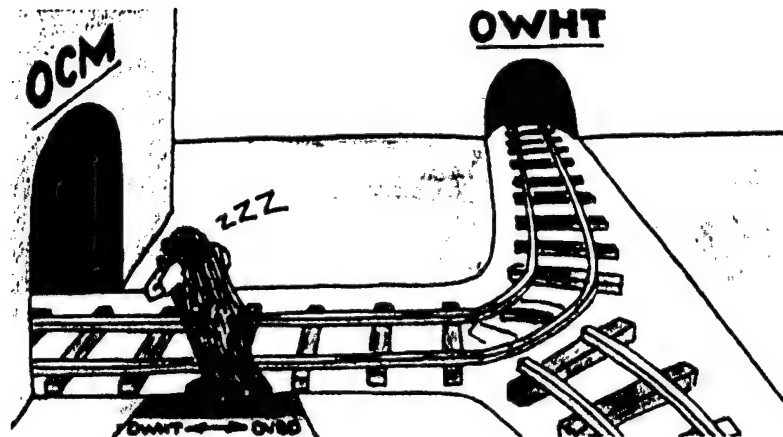
*with the water?*

The OCM will detect oil present in the water and reroute the oily water to the OWHT.

The Diverter Valve controlled by the OCM will route all water to the OWHT *unless* the OCM specifically allows water to be discharged overboard.

*What if our OCM is*

*on the blink?*



**CAUTION!**

If the bilge water is contaminated by detergents, particularly AFFF, the oil will not coalesce!



*Not Good!*



*Much Better*

*If the equipment is maintained to spec and operated properly, the OPA system on your ship will clean oily waste from your bilge water so that you can pump the water over the side without violating the law. The OPA system stores captured concentrated oil in the WOT for disposal by shore facilities.*

## *Now Hear This...*

*There are always rules to follow. What are they?*

The ship should contaminate as little of its bilge water with oil as possible. Use mechanical seals in oil and water pumps and properly segregate oily water from non-oily water using the drain collecting system, if installed.

Use only short-lived detergents to clean bilges. Formula P-98 is an acceptable type of short-lived detergent. **DO NOT USE** bilge cleaners or chemical agents that promote chemical emulsion.

Off-load oily waste containing chemical emulsion agents *only when in port and only to shore receiving facilities. DO NOT USE* oil disposal rafts (shoreside donuts) to off-load oily waste.

### *Bilge Water & Oily Wastes*





*Oil/Water  
Separator*



*Shore  
Facilities*

While in port, oily bilge water can only be disposed using one or more of the methods described below.

Ships equipped with an OWS and an OCM may use them *if and only if* the effluent does not cause a sheen or cause a violation of any other applicable water quality standard.

Pump oily bilge wastes directly to permanent shore reception facilities if adequate oil/waste collection lines are available and if an OWS has not been installed on your ship.

If the OWS on your ship is broken, pump oily bilge wastes directly to shore facilities.

*Barges*

Your ship may transfer oily waste to barges or tanker trucks *if and only if* your ship is not equipped with an OWS (or your OWS is broken) *and* there are no oil waste collection shore lines available for your use.

*Eductors*

**DO NOT USE** eductors to pump bilges that contain oily waste *unless there is an emergency and you don't have an OPA system* (OWS/OWHT at minimum) that can handle the immediate flow needed. If you

must use eductors, make every effort to discharge the oily waste in waters beyond 12 nm from land and while your ship is underway. If this situation occurs, you are required to make an engineering log entry that documents your use of the eductors to pump bilge waste overboard.

Crews shall make maximum use of available port facilities to dispose all waste/used oil products before their ship departs port and when it returns to port. Navy and international regulations prohibit discharge of waste oil overboard.

Crews shall collect and separately store and label used lube oils for reclamation by shore facilities. Crews *shall not* discharge lube oils into bilges, OWHTs, or WOTs, since they can be readily recycled at shore facilities.

Crews shall collect synthetic lube and hydraulic oils separately from petroleum-based used/waste oils. If the ship doesn't have a dedicated system that collects used synthetic oils, the crew shall use either 5- or 55-gallon steel containers, that are properly labeled, to

### *Waste & Used Oil*

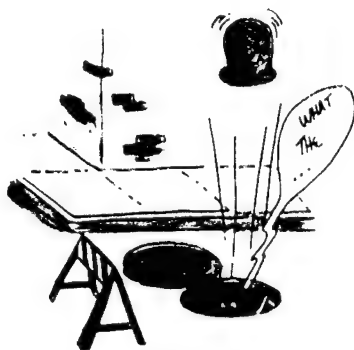




collect such materials for recycling at shore facilities. *Anyone handling synthetic oils shall follow appropriate safety precautions.*

The crew shall retain and properly label containers used as original packing for oil products. These containers can be used to store and transfer used/waste oil to shore facilities.

### *Fuel Transfer*



When crews must conduct fueling, defueling, internal fuel transfers, and oil off-loading operations in restricted waters, those operations *shall be done during normal daylight working hours by well-trained persons.* The crew shall take actions, such as those listed below, to minimize the possibility of accidentally spilling oil.

- *Maintain topside watches where spills may occur. Persons standing these watches shall be able to communicate directly with the fuel transfer pump stations.*
- *Establish check-off lists and procedures for aligning valves and conducting transfer operations.*

- 
- *Double-check all valves beforehand.*
  - *Everyone assigned to participate in oil transfer operations shall be qualified to perform his or her assigned tasks.*
  - *Monitor each tank level constantly when it is being filled with fuel. Use remote tank-level indicators as your primary method to determine the level in the tank.*
  - *Before beginning the transfer of fuels, those personnel assigned to conduct the operation shall inform both the responsible ship's officer (CO, CDO, OOD) and the fuel supplier that the ship is ready to begin the operation.*

Oil/water interface detectors, cargo tank cleaning systems, and segregated ballast tanks (on oilers and oil tankers).

*Other Components*

*Don't Forget the  
Sensors!*

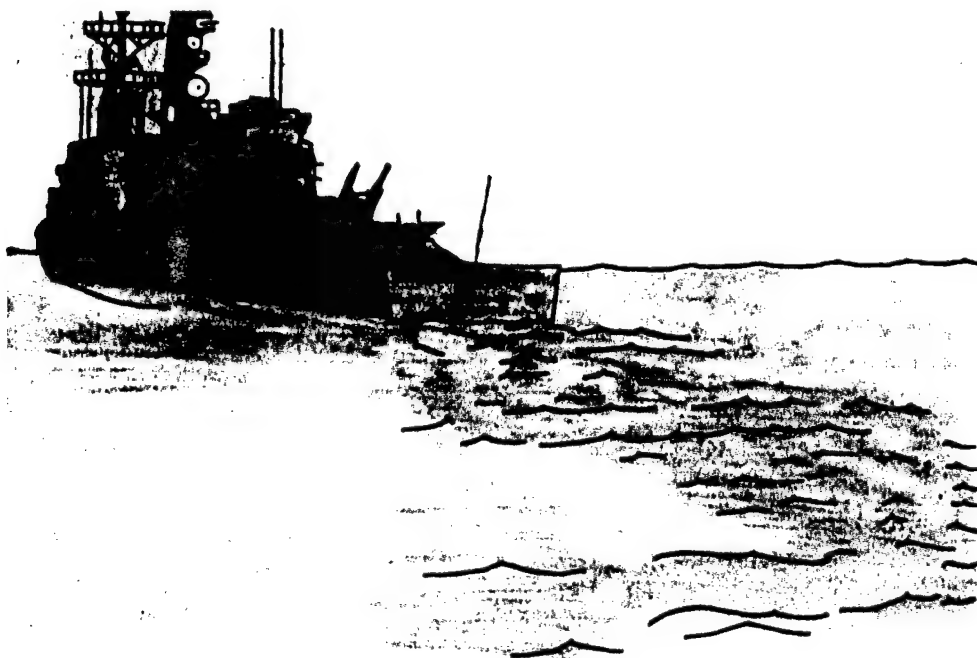


# *You and the Law*

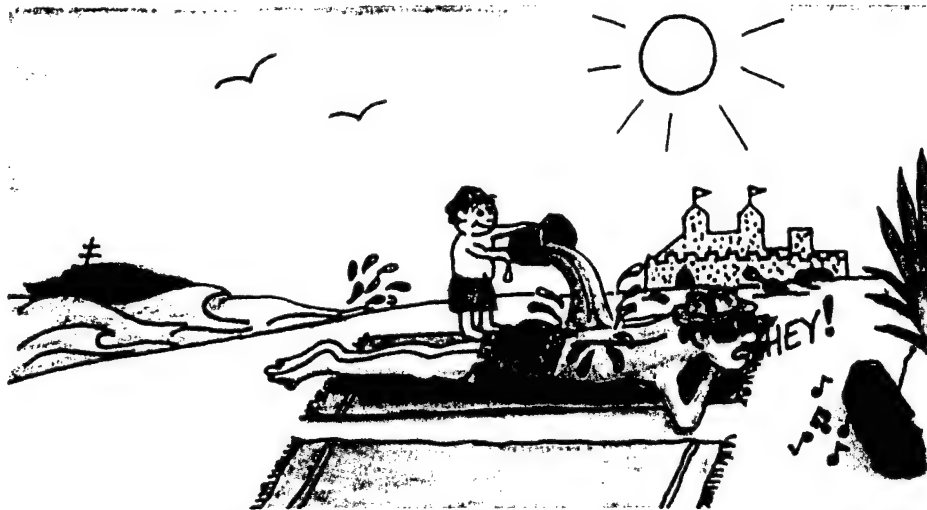
*"There's the right way, the wrong way, and..."*

Pollution doesn't mean much to us unless—  
or until—it hits us from a legal or a personal  
perspective, or both.

*Why bother?*



Consider all of the ships at sea and in port or harbor. Consider all of the machinery spaces on them and the oily water collected in their bilges. Now, think of you and your family and your friends enjoying a weekend of sand and surf by Virginia Beach or on Coronado's Silver Strand: *do you want them (and yourself) to be exposed to the oil in bilge water?*



The law is a bit more complicated. The following paragraphs introduce and briefly describe the legal requirements that govern how you and your Commanding Officer must treat oily water before discharging it over the

side. These requirements flow from what we call the MARPOL.

The United States signed the *International Convention on the Prevention of Pollution from Ships* and the US Senate ratified this treaty. In the case of oil and oily waste, the naval ships (combatants, submarines, and auxiliaries) of signatory states are not specifically required to meet MARPOL standards. In the US, the APPS governs our implementation of the MARPOL.

*What is the  
MARPOL?*



**OWHT**

**START**

LEAKS DETECTED! MAINTENANCE IS LAGGING! FULL BILGE!

LEAKAGE ALSO STEMS HERE!

EXCESSIVE LEAKAGE! INSTALL MECHANICAL SEAL!

**BILGE**

DRY BILGE! COLLECT 100 GALLONS!

NO DICE! DON'T GAMBLE WITH OILY WASTE!

**MARPOLY**

DISCHARGING OILY WASTE OVERBOARD IS NO GAME!

NO OIL DETECTED! YOU WIN! GO OVER!

NO CHANCE!

OILY WASTE PUMPED OVER! LIBERTY CANNED! IMPROVES!

NO CHANCE!

EMULSIFIED WITH AFFF OR HEAVY DETERGENTS! LOSE A TURN

WATER HITS THREE PRONGED SENSOR - VALVE SHUT!

PASS PLATES OIL COALESCES. GO DIRECTLY TO OCM!

OWHT

COIL TANK OVERFLOWS TO BILGE!

LEAKS FROM MACHINE LEAVES BILGE QUITE A SHEEN!

OVERD HOSE CONNECTION GO TO WASTE OIL TRICK ON PIER!

LAST EVEN FORECAST OIL CLEANED GO TO WASTE!

CONDENSATE FROM UNINSULATED HULL RAISES BILGE LEVELS

LOSE BIG \$

OWHT TO OWS! NO BULK OIL HERE!

OWS

DO NOT USE TO PUMP BILGES GO TO OWHT START OVER

NO CHANCE!

OCM

SYSTEM MALFUNCTION! RETURN TO OWHT AND START OVER

P-250 HIGH BILGE CLEAN. OIL EFFLUENT NOT TOO SLICK!

GONE FISHING!

*Do You Want to Play a Game?*

The *Act to Prevent Pollution from Ships* (33 USC 1901 et seq.) is the law passed by the Congress and signed by the President that implements our participation under the MARPOL. With respect to discharges of oil and oily water, the APPS requires U.S. vessels to comply with MARPOL requirements to a *reasonable and practical* extent.

*What is the APPS?*



The CNO *Environmental and Natural Resources Program Manual*, OPNAVINST 5090.1B, describes the Navy's comprehensive program to prevent or mitigate pollution

OPNAVINST

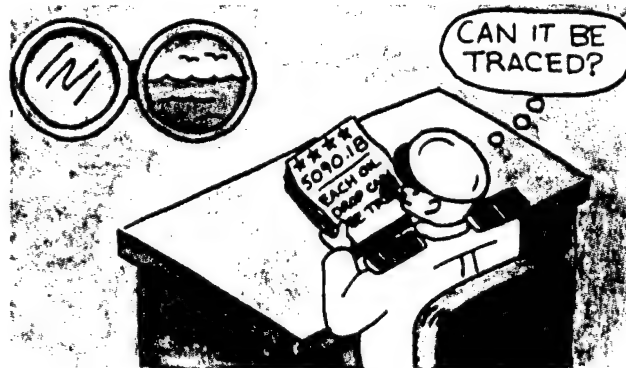
5090.1B ...

resulting from service-wide and command-level activities. OPNAVINST 5090.1B instructs commands and facilities to take the actions described below to prevent or mitigate pollution.

1. *Ships shall not discharge water that produces a sheen in US territorial waters.*
2. *Ships operating in MARPOL Annex 1 special areas<sup>1</sup> shall not discharge oil or oily waste unless compliance endangers the ship or impairs its operations and operational effectiveness.*

**NOTE:**

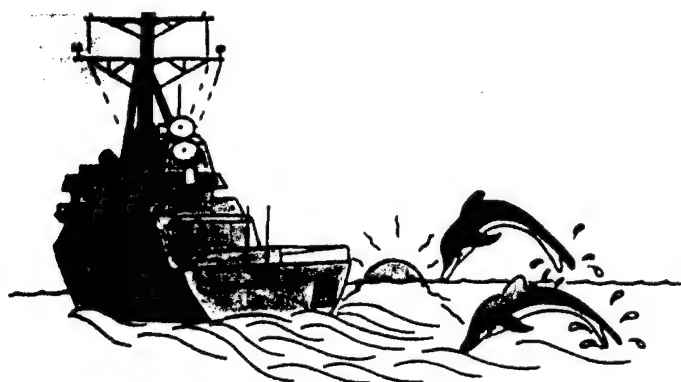
Your ship's OWS may be used in these locations.



1. *These special areas are the Mediterranean Sea, Black Sea, Baltic Sea, and the Antarctic area.*

The OPA system on your ship allows your Commanding Officer the ability to pump out the bilges inside of U.S. territorial waters and within any MARPOL special area, if circumstances require it. The system separates oil from water, monitors the oil content of the water that has been processed by the separator, and ensures that the only water allowed overboard meets statutory requirements. OPNAVINST 5090.1B further explains the requirements and restrictions concerning oily waste discharges within MARPOL special areas or anywhere on the high seas.

## *Why an OPA System?*



Regardless of the operating area, Navy ships equipped with an OWS and an OCM shall limit all discharges of oily water to 15 ppm of oil and shall off-load waste oil to port facilities.

## *Oil/Water Separator & Oil Content Monitor*

## *Oil/Water Separator Only*

Commanding Officers of ships that are equipped only with an OWS are required to process all machinery space bilge water through the OWS before discharging the water over the side and monitor the discharge for oily sheen. The oil recovered by the OWS shall be retained in the WOT until it can be off-loaded to port facilities.

### **CAUTION!**

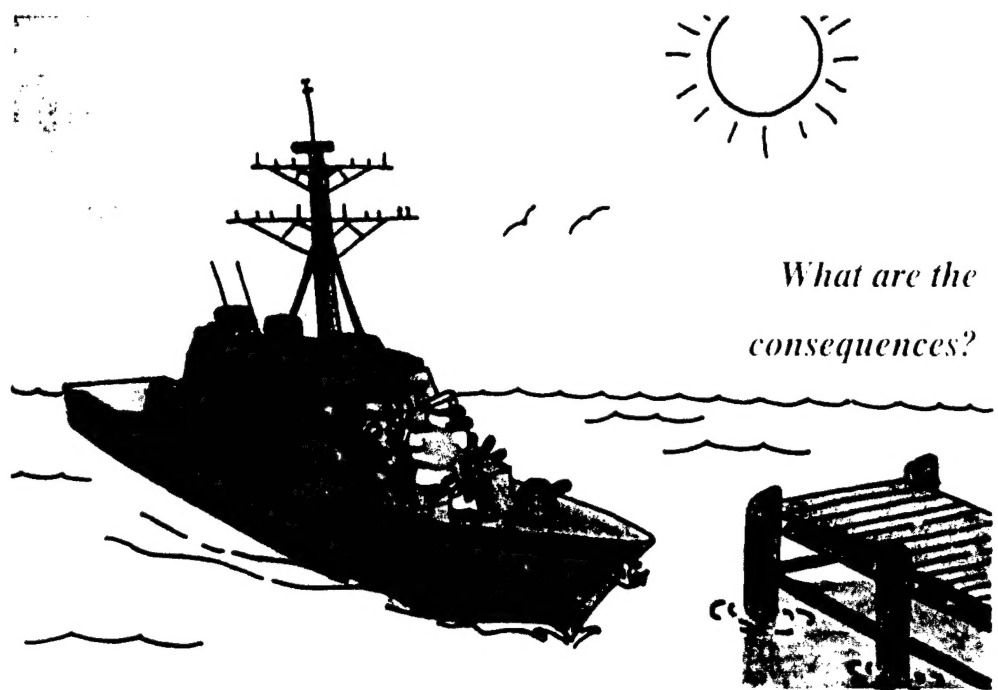
**If the bilge water is contaminated by detergents, particularly AFFF, the oil will not coalesce!**

## *No OPA System*

If your ship has no OPA system available, but it does have an Oily Waste Holding Tank, OPNAVINST 5090.1B directs that *all* oily bilge water *shall be* collected and held for disposal using port facilities.

If your ship has neither an OPA system nor an OWHT/WOT, you are required to retain all oily bilge water for shore disposal. If operating conditions require you to dispose of this water at sea, the *ship shall be underway*

and *more than 50 nm* from the nearest land  
before discharging oily water.



*What are the  
consequences?*

If you and your ship comply with the law,  
then you've done right and the waters of  
the oceans and harbors of our world are a  
little cleaner and clearer.

*Remember this?*

